Appendix A

RECORD OF DECISION

Operable Unit 1 - Soil and Groundwater

Martin Aaron Superfund Site,

City of Camden, Camden County, New Jersey

United States Environmental Protection Agency

Region II

September 2005

DECLARATION STATEMENT

RECORD OF DECISION

SITE NAME AND LOCATION

Martin Aaron Site (EPA ID# NJD014623854)
City of Camden, Camden County, New Jersey
Operable Unit 1

STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy to address contaminated soil and groundwater located on the Martin Aaron site, in the City of Camden, Camden County, New Jersey. The soil and groundwater are contaminated primarily with volatile organic compounds (VOCs) and arsenic. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for this site.

The State of New Jersey concurs with the Selected Remedy.

ASSESSMENT OF THE SITE

The response action selected in this Record Of Decision (ROD) is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances from the site into the environment.

DESCRIPTION OF THE SELECTED REMEDY

The response action described in this document represents the first and only planned remedial phase, or operable unit, for the Martin Aaron site. It addresses soil and groundwater contamination at the site.

The Selected Remedy for soils involves excavation, transportation and disposal of approximately 28,000 cubic yards of contaminated soil containing VOCs and arsenic which act as a continuing source of groundwater contamination. The excavated soil will be treated, if necessary, prior to land disposal. Residual soil contamination that remains on the site will be capped with asphalt or a similar material. The Selected Remedy for groundwater comprises groundwater collection, on-site pretreatment, with discharge of the treated water to the publicly owned treatment works (POTW).

The major components of the selected response measures include:

- excavation of approximately 28,000 cubic yards of highly contaminated soil from the arsenic and VOC source areas;
- capping of the residual soil contamination that still poses a direct contact threat;
- off-site transportation and disposal of contaminated soil and debris, with treatment of all hazardous waste prior to land disposal, as necessary;
- backfilling and grading of all excavated areas with clean fill;
- installation of groundwater extraction wells to extract and pretreat the contaminated groundwater, as necessary, prior to discharge to the local POTW;
- implementation of a long-term groundwater sampling and analysis program to assess migration and possible attenuation of the groundwater contamination over time; and,
- institutional controls, such as a deed notice, to prevent exposure to residual soils that may exceed levels that would allow for unrestricted use, and a Classification Exception Area, to restrict the installation of wells and the use of groundwater in the area of groundwater contamination.

DECLARATION OF STATUTORY DETERMINATIONS

Part 1: Statutory Requirements

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and treatment technologies to the maximum extent practicable.

Part 2: Statutory Preference for Treatment

The Selected Remedy satisfies the statutory preference for treatment as a principal element of the remedy because it addresses the principal threat wastes at the site through treatment.

Part 3: Five-Year Review Requirements

This remedy will result in hazardous substances, pollutants, or contaminants remaining on the Martin Aaron site above levels that would allow for unlimited use and unrestricted exposure. Pursuant to Section 121(c) of CERCLA, a statutory review will be conducted within five years of the initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and environment.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for the site.

- Chemicals of concern and their respective concentrations may be found in the "Site Characteristics" section.
- Baseline risk represented by the chemicals of concern may be found in the "Summary of Site Risks" section.
- A discussion of cleanup levels for chemicals of concern may be found in the "Remedial Action Objectives" section.
- A discussion of source materials constituting principal threats may be found in the "Principal Threat Waste" section.
- Current and reasonably-anticipated future land use assumptions are discussed in the "Current and Potential Future Site and Resource Uses" section.
- A discussion of potential land use that will be available at the site as a result of the Selected Remedy is discussed in the "Remedial Action Objectives" section.
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs are discussed in the "Description of Alternatives" section.
- Key factors that led to selecting the remedy (i.e., how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decisions) may be found in the "Comparative Analysis of Alternatives" and "Statutory Determinations" sections.

George Pavlou, Director
Emergency and Remedial Response Division
EPA - Region II

9/30/05
Date

Decision Summary

Operable Unit 1 - Soil and Groundwater

Martin Aaron Superfund Site,

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SITE NAME, LOCATION AND BRIEF DESCRIPTION

The Martin Aaron site is located in the City of Camden, Camden County, New Jersey. The site includes four areas: (1) the Martin Aaron property; (2) the semi-vacant property bordering to the north referred to as the scrap-yard; (3) Comarco Foods property located adjacent to Martin Aaron to the South; and (4) various small locations adjacent to the Martin Aaron property which include the Ponte Equities property to the south and various right-of-way locations on Everett, Sixth and Jackson Streets. An overview map of the locations addressed in this ROD is shown in Appendix I, Figure 1.

The area surrounding the site is an urban mixture of industrial and residential uses, with many vacant or abandoned lots. The Martin Aaron property is currently zoned for commercial use. The property consists of a fenced 2.4-acre parcel with one remaining building formerly occupied by Rhodes Drums. The property is covered with vegetation and the remains of former building foundations.

There are no known drinking water or industrial production wells near the Martin Aaron site or the surrounding properties. Camden County Municipal Utilities Authority (CCMUA) provides sewer service to the City of Camden. Camden Water, a private contractor for the City of Camden, provides drinking water to approximately 105,000 people. The nearest Camden Water well is located approximately 1.75 miles east-northeast of the site. This well (City Well #7) is used as an emergency water supply well only.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

Records indicate that the Martin Aaron property has been used for light industrial activities since, at least, 1886. Until at least 1940, various hide tanning, glazing, and related operations were performed on this and neighboring lots. In 1968, Martin Aaron, Inc., purchased the property, and is currently the owner of record. From 1968 to 1987, Martin Aaron operated a drum recycling business. In 1985, Westfall Ace Drum Company (WADCO), also known as Drum Services of Camden, began operating at the site. In addition, Rhodes Drums, Inc., also operated at the site from around 1985 until it ceased business in 1998. WADCO occupied the main on-site building (referred to as the Martin Aaron building), while Rhodes Drums operated from a smaller building in the southeastern corner of the property (known as the Rhodes Drums building). WADCO was liquidated in bankruptcy proceedings in 1994.

Martin Aaron, WADCO and Rhodes Drums would arrange for the removal of used drums from businesses for a fee and transport the drums to the site for reconditioning. EPA has learned that the drums contained residues of material, including hazardous substances. The drums were drained of residue, pressure-washed with a caustic solution, water-washed, rinsed, steam-dried and repainted according to client specifications.

From 1981 to 1995, New Jersey Department of Environmental Protection (NJDEP) and U.S. Environmental Protection Agency (EPA) issued numerous Notices of Violations, Administrative Orders and other enforcement actions against the operators of the site. Violations included un-permitted discharges of hazardous waste, non-notification of spills or releases, improper storage of waste drums, improper waste handling and disposal, improper labeling of hazardous waste containers, hazardous waste storage violations, and others.

In 1987, NJDEP, under a search warrant issued by the Department of Law and Public Safety, collected samples from buried drums exposed in test pits, sludge from sewer basins, soils, and effluent samples. The results confirmed the presence of hazardous waste in drums and elevated levels of metals in soil above appropriate NJDEP criteria. Sludge and effluent samples from sewer basins contained elevated levels of volatile organic compounds (VOCs) and metals. Interviews with employees indicated that drum residues were allowed to drain into the ground and that drums containing wastes from the cleaning process were also buried on site. Also, NJDEP determined that a portion of the residual material generated from the drum cleaning operations drained into basins that emptied directly into the ground. Execution of the search warrant led to the indictment and conviction of one of the operators of the site, Martin Aaron, Inc. and its president, Martin Aaron, on charges of improper disposal of hazardous waste.

After the operators failed to respond to numerous directives issued by NJDEP to clean up the site, NJDEP conducted several interim remedial measures from 1995 to 1999. NJDEP removed soil, approximately 700 drums of chemical wastes, 10,000 empty drums, dumpsters filled with mixed wastes, and a few underground storage tanks (USTs). Concurrent with the NJDEP's actions, in 1998, the City of Camden demolished the Martin Aaron building, the main building used for drum reconditioning operations, because it was in danger of collapsing.

In 1997, NJDEP initiated a Remedial Investigation (RI), using state funds, for both soil and groundwater to determine the nature and extent of contamination at the Martin Aaron site.

NJDEP's investigation activities included site mapping, a geophysical investigation to identify buried drums, a stability investigation of the buildings on site, and large-scale soil and groundwater sampling. The investigation was conducted primarily at the Martin Aaron property and at the South Jersey Port Corporation (SJPC) property, located across the street to the west of the Martin Aaron property. The SJPC property was previously used by Martin Aaron as a drum storage area and its building was used for administrative purposes.

Over 160 soil borings were installed by NJDEP to identify the areal extent of soil contamination. Sampling was conducted in and around potential contaminant source and disposal areas, and in sewer basins and other areas of potential contaminant migration. Surface and subsurface soil samples were collected inside and outside of buildings on the property, in UST areas, test pits and trench excavations. Groundwater samples were collected from monitoring wells and the nearest municipal supply well.

The NJDEP RI soil results showed that both surface and subsurface soil contamination was widespread throughout the Martin Aaron property and extended beyond property lines. Contaminants detected included chlorinated and aromatic VOCs, semi-volatile organic compounds (SVOCs) consisting mostly of poly-aromatic hydrocarbons (PAHs), metals, pesticides and polycyclic-chlorinated byphenyls (PCBs). The NJDEP study also found groundwater contamination in both shallow and some of the deeper monitoring wells installed on the property.

The site was placed on the National Priorities List (NPL) in 1999, and EPA became the lead agency for the Martin Aaron site. EPA took additional removal actions, ending in 2001, to remove empty and full drums of waste that were abandoned outside the Rhodes Drums building. EPA removed 68 drums of hazardous waste, hundreds of empty drums, several buried drums, storage tanks, and a limited amount of contaminated soil and debris from the vicinity of the Rhodes Drums building. The property was also fenced to prevent trespassing.

EPA identified Martin Aaron, Inc., and Rhodes Drums as potentially responsible parties (PRPs) liable for payment of response costs for cleanup of the site. After evaluating these entities, EPA concluded that they lacked the financial resources to fund or perform the Remedial Investigation/Feasibility Study (RI/FS).

In 2003 and 2004, EPA identified a number of additional companies as PRPs for the site. These companies were customers of the operators of the drum reconditioning facilities. EPA has notified the generators that they are considered PRPs for the site.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

Since the Martin Aaron site's placement on the NPL, EPA has worked closely with public officials and other interested community groups and concerned citizens.

On July 15, 2005, EPA released the RI/FS, the Proposed Plan, and supporting documentation for the soil and groundwater remedy to the public for comment. These documents were made available to the public in the administrative record repositories maintained at the EPA Region II office (290 Broadway, New York, New York 10007) and the Camden Free Public Library (418 Federal Street, Camden, New Jersey 08103). EPA published a notice of availability involving the above-referenced documents in the Courier-Post newspaper on July 15, 2005. The public comment period on these documents was scheduled from July 15, 2005 to August 15, 2005.

On July 26, 2005, EPA held a public meeting at the Camden County Municipal Utilities Auditorium, to inform local officials and interested citizens about the Superfund process, to discuss the findings of the RI/FS, to propose the remedial alternatives at the site, and to respond to questions from area residents and other attendees.

Due to several requests at the public meeting to extend the public comment period, EPA published a notice in the Courier-Post on August 12, 2005, extending the public comment period for an additional 30 days ending on September 14, 2005.

Responses to the comments received at the public meeting and in writing during the public comment period are included in the Responsiveness Summary section of this ROD (see Appendix V).

SCOPE AND ROLE OF OPERABLE UNIT

This action, referred to as Operable Unit 1 (OU1), will be the only action for the site, addressing both contaminated soil and groundwater. EPA's findings indicate the presence of "principal threat" wastes at the site, primarily on the Martin Aaron property.

Concurrent with EPA's RI/FS, NJDEP and the South Jersey Port Corporation entered into discussions regarding potential remedies for the SJPC property under a separate action. After evaluating previous site uses along with EPA and NJDEP sampling results, NJDEP concluded that the contamination at the SJPC property is more likely attributed to "historic fill" in the area than from the Martin Aaron site operations. Site records indicate that Martin Aaron, Inc., leased part of the SJPC property for drum storage and possible administrative purposes. Both EPA and NJDEP RI sampling results in areas believed to be used by Martin Aaron had similar results when compared to areas not used by Martin Aaron or the other operators. NJDEP also concluded that the contamination on the SJPC property, primarily metals and PAHs, did not appear to be a source to the groundwater contamination in the area.

Given these conditions, NJDEP, with EPA's concurrence, plans to proceed with a remedy for the SJPC property (also known as the Liedke property), independent of the Martin Aaron site. NJDEP's Technical Regulations require that if "historic fill" material is not treated or removed from a site, engineering and institutional controls shall be implemented. An engineering control (such as asphalt capping) would be required at the SJPC property prior to reuse, along with a deed notice to assure the long-term maintenance of the cap.

This ROD addresses the contaminated soils and groundwater for the Martin Aaron site and the adjacent properties previously indicated, not including the SJPC property.

SUMMARY OF SITE CHARACTERISTICS

Given the extensive NJDEP investigation, the scope of EPA's field investigations were meant to supplement the NJDEP RI data and fill data gaps. Response actions during 1999 to 2001 were performed partly in response to NJDEP's RI results, and resulted in considerable changes in conditions at the site, with the removal of known contaminated soil areas, along with USTs, above-ground tanks, piping and process equipment. In addition to documenting the conditions after the removal action, EPA's study evaluated data gaps on neighboring properties, collected data that could be used for a human health risk assessment, and supplemented the groundwater investigation performed by NJDEP.

EPA's RI included areas identified as the Martin Aaron property, the SJPC property (west of Broadway), the scrap-yard (north of the Martin Aaron property), Comarco Products (a food processing facility to the south), the Ponte Equities property (unoccupied warehouse buildings, also to the south), and various properties and right-of-ways on Everett, Sixth, and Jackson Streets.

A review of property records for this section of Camden identified large tracts that required landfilling prior to development. The entire Martin Aaron study area was the subject of this type of landfilling, beginning in the 19th century. NJDEP and EPA site investigations identified as much as six to 10 feet of fill throughout the study area. Studies by NJDEP have attributed elevated levels of certain groups of contaminants to this type of "historic fill" and NJDEP has established remedial practices for addressing areas where "historic fill" is encountered. The EPA RI sought to identify contaminants that might be attributable to "historic fill" as distinguished from contamination problems attributable to the previous site operations.

Surface Soil Contamination

Surface soil samples were collected from 60 locations throughout the Martin Aaron and SJPC properties, the property referred to as the scrap-yard, Comarco Products, the Ponte Equities property, and on the Everett and Sixth Street rights-of-way. Laboratory results were compared to site-specific screening levels for a wide range of contaminants.

VOC contamination above screening levels was detected in the surface soil within the limits of the Martin Aaron property, but on no other properties investigated. A map of the site VOC contamination results is presented in Appendix I, Figure 2. The most frequently detected VOCs were tetrachloroethylene (PCE), trichloroethylene (TCE), and cis-1,2-dichloroethylene (cis-1,2-DCE), though a variety of different solvents were detected. This pattern is consistent with a drum reconditioning facility that would have handled liquids from a variety of unrelated operations.

SVOCs were detected at 58 of 60 surface soil sampling locations, across the entire study area. With few exceptions, the SVOCs identified in surface soils were poly-aromatic hydrocarbons (PAHs), which are frequently detected in urban soils. PAHs were generally higher on the Martin Aaron property than on other properties, with the highest concentrations in the former process and drum storage areas of the Martin Aaron operation. The earlier tannery operations would have used coal for heating and drying hides, and these same areas of the Martin Aaron property also coincide with former coal storage areas from this earlier operation. The presence of PAHs in surface soil outside of operational areas at the site appears to be associated with "historic fill" at these properties.

Metals above screening levels were detected in virtually all of the surface soil samples collected. Arsenic, barium, and lead were detected most frequently. It is likely that metals exist at elevated levels due to the presence of "historic fill" material at the site and surrounding properties. Industrial operations on neighboring properties probably also played a factor: a glass-making company, a possible source of barium, operated on the scrap-yard property; and a lead smelter operated across Sixth Street from the site. Higher concentrations of metals, particularly arsenic, were found in suspected source areas at the Martin Aaron property, which suggests that there is also a site-related contribution of metals. Arsenic may be attributable to the drum reconditioning operations, but is also typically a remnant of tannery operations.

Pesticides were infrequently detected in the study area. PCBs were detected above screening levels in only four surface soil samples ranging from 2 to 19 parts per million (ppm).

During the EPA RI, EPA conducted field screening for radiation for surface and subsurface soil. Field screening results were negative for radiation, therefore, no further analysis was performed for radioactive compounds.

Subsurface Soil Contamination

Subsurface soil samples were collected at 72 sampling intervals at depths ranging from greater than two feet below ground surface (bgs) to approximately 21 feet bgs.

For subsurface soil, VOCs were detected almost exclusively on the Martin Aaron property. Similar to the surface soil results, 14 different VOCs were detected in subsurface soil, though few with any frequency (PCE was the most frequently detected). For example, PCE (with a screening level of 0.06 ppm) was detected with a level of 110 ppm near a location where the former Martin Aaron building existed. At a different location near the middle of the Martin Aaron property, TCE (with a screening level of 0.06 ppm) was found at 630 ppm, and PCE was not detected. These areas were found at between four and seven feet bgs. The results suggest that drum reconditioning operations contributed to VOC contamination in subsurface soil at different locations on the property.

SVOCs were identified above screening levels at the Martin Aaron property, in the rights-of-way on Everett Street and Sixth Street, and on the SJPC property. As with the surface soils, the SVOCs detected most frequently in subsurface soil were PAHs that have also been associated with "historic fill." There is some correlation between SVOC concentrations and, for instance, the Martin Aaron building VOC area on the Martin Aaron property. Elevated SVOCs were identified in the northeastern corner of the SJPC property. The results suggest that SVOCs migrated to subsurface soils as a result of operations at the Martin Aaron site and, possibly, from other sources, as well as contributions from the presence of fill material at these properties.

Metals were found on all properties sampled and at most sampling locations. Metals above screening levels include: antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium and thallium. The metals appear to be attributable to "historic fill" material or possibly from other sources at these sampling locations, with the exception of arsenic, which appears at concentrations as high as 23,300 ppm near the Martin Aaron building. By contrast, several of the highest concentrations of lead, the most frequently detected metal, were found across Sixth Street in the right-of-way, near the former smelting facility.

Pesticides were infrequently detected in subsurface soil and pesticide concentrations were relatively low (i.e dieldrin was detected in the range of 0.006 to 0.69 ppm). PCBs were also infrequently detected above screening levels. PCBs had been detected with more frequency in NJDEP's RI, but it appears that the 1999-2000 removal actions substantially addressed site PCBs.

The Rhodes Drum Building

The one building still remaining on the Martin Aaron property, referred to as the Rhodes Drums building, is actually part of a larger one-story structure that is primarily situated on the neighboring Ponte Equities property. This one-story building, along with another much taller building on the Ponte Equities property, are currently unoccupied. Rhodes Drums apparently used the smaller section situated on the Martin Aaron property for its drum recycling operations. The original one-story building (situated across the property line of the Martin Aaron and Ponte Equities properties) was most likely built by the Castle Kid Company as part of their tanning operations in the early 1900s. Since that time, the buildings on the Ponte Equities property are known to have been used as a book bindery and as a warehouse.

A safety inspection determined that it would be unsafe to perform sampling activities inside the Rhodes Drums building. NJDEP's earlier investigation of the Rhodes Drums building identified soil contamination in excess of NJDEP soil cleanup criteria. The soil contamination found included VOCs, PAHs, metals, and pesticides/PCBs. EPA soil sampling results adjacent to the Rhodes Drums building support NJDEP findings.

For the other two structures on the Ponte Equities property, no sampling was performed because the potential connection to earlier tannery operations was not known until well after the completion of the RI field work. Additional investigations on and around these buildings will be necessary to determine if the tanning operations resulted in contamination of the one-story Ponte Equities building.

Groundwater Contamination

In order to evaluate hydrogeologic conditions and groundwater quality beneath the site, a total of 24 monitoring wells were installed as part of EPA's RI. An additional 10 wells from the NJDEP RI were also sampled. Two rounds of groundwater sampling were conducted in June and September of 2002. In addition, a city water supply well (City Well #7) was also sampled.

The groundwater table is generally found about four to seven feet bgs. Below the fill at the site, the hydrogeology is made up of several layers of the Potomac-Raritan-Magothy (PRM) aquifer, which is composed of layers of gravel, sand, silt and clay. The Upper and Middle PRM aquifers were investigated as part of this study. A number of the monitoring wells were placed at or near the water table, within the first 20 feet bgs, and are considered "shallow" wells. Site groundwater monitoring wells were also placed within the first 100 feet bgs, or within the Upper PRM Aquifer. The Upper PRM Aquifer is a sand and gravel layer that is separated from deeper units by less conductive clay/silt lenses. A few monitoring wells were also installed to approximately 180 feet bgs, in the Middle PRM Aquifer. Groundwater at the site generally moves to the southeast, influenced by municipal pumping wells.

Groundwater samples were analyzed for VOCs, SVOCs, metals, and PCBs. A map of the site groundwater contamination results is presented in Appendix I, Figure 3. VOC contamination in the "shallow" wells is primarily limited to within the Martin Aaron property boundary. As with VOC-contaminated soils, 12 different VOCs were detected, led by cis-1,2-DCE, benzene, TCE and PCE. Of the highest concentrations detected, cis-1,2-DCE was found as high as 330 parts per billion (330 ppb) and benzene as high as 31 ppb. While many metals were detected above screening levels in the "shallow" wells, only arsenic, detected as high as 7,130 ppb, appears to be site-related.

In the Upper PRM Aquifer wells, which were screened between 30 and 60 feet bgs, VOCs detected above screening levels include cis-1,2-DCE, TCE, vinyl chloride, dichloropropane, and benzene. VOCs were primarily identified in groundwater samples collected from the Martin Aaron property, with a trend of groundwater contamination moving to the southeast, consistent with the direction of groundwater flow. Groundwater VOC contamination near the Martin Aaron building is elevated but substantially lower (i.e. cis-1,2-DCE at 37 ppb) at this depth. Arsenic was also found at this depth, though at substantially lower concentrations than in the shallow wells.

In wells from deeper units (more than 100 feet bgs), specific VOCs identified as TCE and vinyl chloride were detected at 1.1 ppb and 6.1 ppb, respectively, which are considered relatively low concentrations. Sampling results of City Well #7, screened at 123 feet bgs, determined that it is not affected by the Martin Aaron site contamination.

Based on groundwater data collected from the RI, a VOC plume, comprised of cis-1,2-DCE, TCE, PCE and several other constituents, covers the entire footprint of the Martin Aaron property and extends several hundred feet beyond the property boundary. The extent of the plume appears to be an area over 1,000 feet long and approximately 600 feet wide in the shallow wells (within the first 20 feet bgs). The plume narrows with depth to approximately 400 feet wide in Upper PRM Aquifer wells at depths of 30 to 60 feet bgs. Vertically, the deepest contamination was found within a confining unit at the base of the Upper PRM Aquifer (approx. 110 feet bgs). The confining unit consists of thin sand and clay layers, and wells installed in these sand layers exhibited the deepest, albeit relatively low VOC concentrations.

A smaller arsenic groundwater plume exists in the shallow aquifer, with arsenic concentrations decreasing with depth. The areal extent of the arsenic plume appears to align closely with the dimensions of the Martin Aaron property.

As previously mentioned regarding radiation screening, EPA did not conduct field screening for radiation in groundwater during this RI. However, during a previous EPA RI for the nearby Welsbach/General Gas Mantle Superfund site, EPA collected groundwater samples from monitoring wells located on the Martin

Aaron property for radionuclide analysis. The radionuclide concentrations in the groundwater samples were found to be below drinking water standards.

CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Site Uses: Prior to the start of the OU1 remedy, the Martin Aaron property was abandoned and fenced off. The Martin Aaron property and the neighboring lots are zoned for industrial use, similar to the current use of neighboring, occupied commercial properties. In discussions with a member of the City of Camden Department of Development and Planning, Division of Planning Office, as well as supporters of the Waterfront South redevelopment project, EPA has been advised that the Martin Aaron property is zoned for economic redevelopment and light industrial usage. Furthermore, Camden expects that the future use of this area will be integrated into the long-range city plans, which might involve some commercial land-use such as a green-market or commercial gas station. In either case, residential re-use is not contemplated.

Ground and Surface Water Uses: Groundwater underlying the site is considered by New Jersey to be Class II-A, a source of potable water; however, no complete exposure pathways to contaminated groundwater are known. All residents in the area of the Martin Aaron site are currently on city-supplied water. If contaminated groundwater is used as drinking water in the future, significant health risks would exist.

SUMMARY OF SITE RISKS

Based upon the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future site conditions. The baseline risk assessment estimates the human health risk which could result from the contamination at the site if no remedial action were taken.

Human Health Risk Assessment

A four-step process is utilized for assessing site-related human health risks for a reasonable maximum exposure scenario: *Hazard Identification* - identifies the contaminants of concern at the site based on several factors such as toxicity, frequency of occurrence, and concentration. *Exposure Assessment* - estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well-water) by which humans are potentially exposed. *Toxicity Assessment* - determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of effect (response). *Risk Characterization* - summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks.

EPA conducted a baseline risk assessment to evaluate the potential risks to human health and the environment associated with the Martin Aaron Superfund site in its current state. Although the risk assessment evaluated many contaminants and several of the potential source areas, the conclusions of the risk assessment indicate that the significant risks are limited to arsenic and benzo[a]pyrene in the soils at the Martin Aaron property, arsenic in the soils of the scrap yard and the properties adjacent to the Martin Aaron property, and arsenic and vinyl chloride in the groundwater of the Upper PRM aquifer. This section of the decision summary will focus on the risks associated with these contaminants in these media. A summary of the concentrations of the contaminant of concern in sampled matrices is provided in Appendix II, Table 1.

EPA's baseline risk assessment addressed the potential risks to human health by identifying several potential exposure pathways by which the public may be exposed to contaminant releases at the site under current and future land use and groundwater use conditions. Future use of the site and the properties adjacent to the site are likely to be commercial/industrial, based on historical land use, current zoning, and future plans for redevelopment. Therefore, exposure to surface and subsurface soils on the Martin Aaron property, the scrap yard area, and the properties adjacent to the Martin Aaron property were evaluated for trespassers, commercial/industrial workers, and construction workers. Groundwater exposures were assessed for future use scenarios assuming that the groundwater would be used as a drinking water. For all media, the reasonable maximum exposure, which is the greatest exposure that is likely to occur at the site, was evaluated.

Under current EPA guidelines, the likelihood of carcinogenic (cancer-causing) and non-carcinogenic (systemic) effects due to exposure to site chemicals are considered separately. Consistent with EPA guidance, it was assumed that the toxic effects of the site-related chemicals would be additive. Thus, carcinogenic and non-carcinogenic risks associated with exposures to individual compounds of concern were summed to indicate the potential risks associated with mixtures.

Non-carcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intake and safe levels of intake (reference doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects. RfDs, which are expressed in units of milligrams per kilogram per day (mg/kg-day), are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media (*e.g.*, the amount of a chemical incidentally ingested from contaminated soil) are compared to the RfD to derive the hazard quotient for the contaminant in the particular medium. The HI is derived by adding the hazard quotients for all compounds within a particular medium that impacts a particular receptor population.

An HI greater than 1 indicates that the potential exists for non-carcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. The toxicity values, including reference doses for the contaminants of potential concern at the site, is presented in Appendix II, Table 2.

The non-carcinogenic hazard indices (HI) that exceed EPA's acceptable level are presented in Appendix II, Table 4. At the Martin Aaron property, HI values for current/future adolescent trespassers exposed to surface soils are estimated to be 3.9, while the HI values for current/future commercial/industrial workers exposed to both surface and subsurface soils are 3.7 and 8.2, respectively. For the scrap yard area, an unacceptable HI value of 5.6 is estimated for the current/future commercial/industrial worker exposed to subsurface soils. Current/future commercial/industrial workers in the properties adjacent to the Martin Aaron property are estimated to have HI values of 2.7 for the surface soils and 2.9 for the subsurface soils. The non-cancer hazard index for workers exposed to groundwater as a drinking water source is 130. In all scenarios, arsenic is the risk driver.

Potential carcinogenic risks were evaluated using the cancer slope factors developed by EPA for the contaminants of potential concern. Cancer slope factors (SFs) have been developed for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to generate an upper-bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes the underestimation of the risk highly unlikely. The SF values used in this risk assessment for arsenic, benzo[a]pyrene, and vinyl chloride are presented in Appendix II, Table 3.

For known or suspected carcinogens, EPA considers excess upper-bound individual lifetime cancer risks of between 10^{-4} to 10^{-6} to be acceptable. This level indicates that an individual has not greater than approximately a one in ten thousand to one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year period under specific exposure conditions at a site. Excess lifetime cancer risks estimated at this site are presented in Appendix II, Table 5. At the Martin Aaron property, the excess lifetime cancer risk estimated for exposure to surface soils by the current/future adolescent trespasser, the current/future commercial/industrial worker, and the construction worker are 2.3×10^{-4}, 6.0×10^{-4}, and 3.8×10^{-4}, respectively, while the excess lifetime cancer risk for construction workers exposed to subsurface soils at the Martin Aaron property is 6.3×10^{-4}. Arsenic and benzo[a]pyrene are the risk drivers at the Martin Aaron property. In the scrap yard area, current/future commercial/industrial workers are estimated to have an excess lifetime cancer risk of 2.5×10^{-4} and 7.9×10^{-4} for exposure to surface and subsurface soil respectively. The cancer risks estimated for current/future commercial/industrial workers exposed to surface and subsurface soils at the properties adjacent to the Martin Aaron property are 3.3×10^{-4} and 3.5×10^{-4}, respectively. For each of these risk estimates, arsenic is the risk driver.

Exposure to groundwater as a potable supply yields an excess lifetime cancer risk of 1.9×10^{-2} for workers, with arsenic and vinyl chloride as the risk drivers. All of these are above the NCP's acceptable risk range. The calculations were based on reasonable maximum exposure scenarios. These estimates were developed by taking into account various conservative assumptions about the likelihood of a person being exposed to these media.

For vapor intrusion associated with the Martin Aaron site, EPA found that the concentrations of VOCs in the groundwater are at levels that could potentially result in exposures to indoor vapors under certain conditions. However, EPA found the highest concentrations in VOCs in the groundwater are concentrated in the center of the site where there are no buildings currently in existence. EPA concluded that there is not an immediate threat to public health in the environment from the vapor intrusion pathway.

Ecological Risks

A four-step process is utilized for assessing site-related ecological risks for a reasonable maximum exposure scenario: *Identification of Chemicals of Concern* - a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. *Exposure Assessment* - a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. *Ecological Effects Assessment* - literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. *Risk Characterization* - measurement or estimation of both current and future adverse effects.

Screening Level Ecological Risk Assessment (SLERA) results indicate the presence of contaminants of potential concern in the Martin Aaron property surface soils. Potential risks were indicated to terrestrial plants and wildlife, and soil invertebrates from direct exposure to PAHs, inorganic chemicals, several pesticides, PCBs, and VOCs. Several VOCs and inorganic chemicals in groundwater were detected at concentrations exceeding ecological screening values, suggesting they could represent a potential risk to ecological receptors if they were to discharge to surface water. However, chemicals in groundwater could represent a potential risk to ecological receptors only if they discharge to a viable aquatic habitat and this pathway has not been established. Therefore, due to the small potential to adversely affect aquatic life and groundwater does not warrant further consideration. Further consideration of these potential ecological risks may be warranted; however, it should be noted that habitats on the Martin Aaron Property have been highly disturbed by past activities and provide only very limited viable habitat for ecological receptors.

Uncertainties

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis
- environmental parameter measurement
- fate and transport modeling
- exposure parameter estimation
- toxicological data

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is uncertainty as to the actual levels present. Environmental chemistry-analysis error can stem from several sources, including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the risk assessment provides upper-bound estimates of the risks to populations near the site, and is highly unlikely to underestimate actual risks related to the site.

More specific information concerning public health and environmental risks, including a quantitative evaluation of the degree of risk associated with various exposure pathways, is presented in the risk assessment report.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in the ROD, may present an imminent and substantial endangerment to the public health, welfare, or the environment.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs) and risk-based levels established in the risk assessment.

The following remedial action objectives for contaminated soil and groundwater address the human health risks and environmental concerns at the Martin Aaron site:

- Reduce or eliminate the direct contact threat associated with contaminated soil to levels protective of a commercial or industrial use, and protective of the environment;
- Prevent erosion and off-site transport of contaminated soils;
- Reduce or eliminate the migration of site contaminants from soil to groundwater;
- Prevent public exposure to contaminated groundwater that presents a significant risk to public health and the environment;
- Remediate groundwater to the extent practicable and minimize further migration of contaminants in groundwater;
- Restore the groundwater to drinking water standards within a reasonable time frame; and,
- Minimize or eliminate organic vapor migration from groundwater into future indoor environments that may be built on the site.

This action will reduce the direct contact excess cancer risk associated with exposure to contaminated soils to one in one million for commercial/industrial use of the site. This will be achieved by reducing exposure to the concentrations of the soil contaminants to the target levels indicated in Appendix II, Table 6 in surface soil (soil within the first two feet of ground surface). Because there are no promulgated Federal or State cleanup standards for soil contamination, EPA established these targets, or Cleanup Goals, based upon the baseline risk assessment. Targets were selected that would both reduce risk associated with exposure to soil contaminants to an acceptable level and ensure minimal migration of contaminants off the site.

EPA has identified arsenic as a principal threat at the site. EPA evaluated the level of arsenic contamination that is more likely to be attributable to "historic fill," which was found at a range of less than 20 ppm to as high as 339 ppm on and off the site, and concluded that soils contaminated with arsenic at concentrations greater than 300 ppm are probably associated with both the tannery and the drum reconditioning operations that took place at the site, and concentrations less than 300 ppm are more typical of "historic fill." An arsenic groundwater plume is also centered on the Martin Aaron property, and the high arsenic contamination levels in soils are probably exacerbating these conditions. Appendix II, Table 6 identifies 20 ppm as a direct-contact Cleanup Goal for arsenic. Appendix II, Table 6 also identifies arsenic Source Areas on Martin Aaron to be soils with arsenic concentrations greater than 300 ppm. Consistent with the NCP, the Feasibility Study evaluated treatment alternatives to address these Source Areas, which are considered principal threats. Because some deeper soils, down to an estimated 10 feet below ground surface, are contaminated with VOCs at levels that act as continuing sources of groundwater contamination, this action will reduce this threat by remediating contaminated soils in excess of 1 ppm total VOCs. EPA has determined that the presence of VOCs in soil is closely linked to Martin Aaron site activities.

Based upon communications with the City and other interested parties, reuse expectations for the Martin Aaron property and neighboring properties are for commercial redevelopment. Of the adjacent properties, only Comarco Products is currently in active use.

As with NJDEP's assessment of the SJPC property, EPA's investigation identified contamination in a number of areas nearby the Martin Aaron property that is consistent with "historic fill" and does not appear to be the result of contaminant releases from the Martin Aaron Superfund site. These areas include the rights-of-way on Everett and Sixth Streets, and a majority of both Comarco Products and Ponte Equities properties. Soil contamination on the Martin Aaron property, the nearby scrap-yard property, and a few areas located on Comarco Products and Ponte Equities properties appear to be attributable to the Martin Aaron Superfund site.

Consequently, EPA has developed direct-contact Cleanup Goals, identified in Appendix II, Table 6, that are appropriate for the Martin Aaron site that would be protective under a future-use commercial redevelopment scenario. These direct-contact Cleanup Goals would also be protective for commercial redevelopment of other neighboring properties; however, they would not be appropriate for an unrestricted future residential use of remediated properties.

There are currently no complete exposure pathways to contaminated groundwater beneath the Martin Aaron site because there are no known contaminated wells in use. All residents in the area of the Martin Aaron site are currently on city-supplied water. If contaminated groundwater is used as drinking water in the future, significant health risks would exist. In addition, if the contaminated groundwater were used in industrial processes within the area, significant human health risks may exist. Finally, vapor intrusion into new or existing structures is a potential exposure pathway from VOCs in groundwater. Thus, remedial actions must minimize the potential for human exposure to contaminated groundwater.

Groundwater within the source area must be remediated to the extent practicable. The presence of clay and silt stringers within the uppermost water bearing zone and high contaminant concentrations in groundwater (specifically of arsenic), make it difficult to restore groundwater to the MCLs or the New Jersey groundwater quality concentrations (GWQCs) in the foreseeable future, even with active remediation of groundwater. Given these uncertainties, this action will, at a minimum, prevent further migration of contaminants to groundwater outside the Source Areas.

Appendix II, Table 7, lists the contaminants of concern found in groundwater at the site, and their respective Cleanup Goals, in this case the drinking water standards (MCLs) or GWQCs. Cleanup Goals were selected that would both reduce the risk associated with exposure to contaminants to an acceptable level and ensure minimal migration of contaminants off the site.

DESCRIPTION OF ALTERNATIVES

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requires that each remedial alternative be protective of human health and the environment, be cost effective, comply with other statutory laws, and utilize permanent solutions and alternative treatment technologies and resource recovery technologies to the maximum extent practicable. In addition, the statute includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility or volume of hazardous substances.

Remedial alternatives for the Martin Aaron site are presented below. The soil and groundwater contamination at the site are expected to be addressed sequentially under a joint remedial approach. The costs for remedial alternatives are presented separately for each media.

CERCLA requires that if a remedial action is selected that results in hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure, EPA must review the action no less often than every five years after initiation of the action. In addition, institutional controls in the form of a deed notice to limit the use of portions of the property may be required, to ensure that future site activities are performed with knowledge of the site conditions, that appropriate health and safety controls would be in place, and, that unrestricted use of the property would not be allowed. The type of restriction and enforceability may need to be determined after completion of the remedial alternatives selected in the ROD. Consistent with expectations set out in the Superfund regulations, none of the remedies rely exclusively on institutional controls to achieve protectiveness. The time frames below for construction do not include the time for remedial design or the time to procure contracts.

Common Elements for Soil Alternatives

Several of the soil alternatives include common components. Alternatives S2 through S6 include the demolition of the Rhodes Drums building (the section located on the Martin Aaron property). Demolition of this building is expected because site contamination has been previously found under the building, and because its poor structural condition could limit the ability to safely remediate other areas of the site. Less is known about the adjoining one-story Ponte Equities building, which may also reside on top of site contamination from its years as part of tannery operations, and may also be found structurally unsound while remediation occurs on the Martin Aaron site. Further studies in remedial design will assess the one-story Ponte Equities building.

The active remedies address surface soil contamination through capping (Alternatives S2 through S6) or excavation and off-site disposal (Alternatives S4, S5 and S6). Alternatives S3 through S6 address principal threat waste (VOC- and arsenic-contaminated soil at concentrations exceeding the Source Area Cleanup Goals) through a combination of different treatment technologies or excavation and off-site disposal.

Since all the soil alternatives result in hazardous substances, pollutants, or contaminants remaining on site above levels that would not allow for unlimited use and unrestricted exposure, a review of the site at least every 5 years would be required.

SOIL ALTERNATIVES

Alternative S1: No Action

Estimated Capital Cost:	*$0*
Estimated Annual O&M Cost:	*$0*
Estimated Present Worth Cost:	*$0*
Estimated Construction Time frame:	*None*

Regulations governing the Superfund program generally require that the "no action" alternative be evaluated to establish a baseline for comparison. Under this alternative, EPA would take no action at Martin Aaron or the surrounding properties to prevent exposure to the soil contamination and the contaminated soil would be left in place. Existing temporary measures (i.e., limited access through fencing) would provide limited protectiveness, but they would not be monitored or maintained.

Redevelopment of Martin Aaron would pose a high risk of direct contact exposure to construction workers and future users, and may exacerbate off-site contaminant migration.

Alternative S2: Capping and Institutional Controls

Estimated Capital Cost:	*$2,970,000*
Estimated Annual O&M Cost:	*$18,500*
Estimated Present Worth Cost:	*$3,310,000*
Estimated Construction Time frame:	*2 months*

Under this alternative, the areas of contaminated soil exceeding the direct-contact Cleanup Goals would be capped to prevent direct contact with the soil contamination. Capping would limit groundwater infiltration through the source areas, reducing the rate of contaminant migration out of the VOC and arsenic Source Areas. Asphalt capping has been specified, for cost-estimation purposes, though a redevelopment plan including a combination of building foundations and other ground covers could be designed that would be protective.

Demolition of the existing Rhodes Drums building at the site would be conducted since soil contamination extends up to the building walls and is believed to extend beneath the building. Further contaminant and structural evaluations performed during remedial design would determine whether other portions of the one-story Ponte Equities building would also need to be demolished.

Institutional controls would consist of land use restrictions that would prevent disturbance of and assure the maintenance of the cap. A deed notice prepared in accordance with the NJDEP Technical Requirements for Site Remediation would need to be placed on the affected properties identifying the areas of soil with contamination, and the areas with site-specific engineering controls. As part of redevelopment plans, properties would also have a requirement for VOC vapor controls for newly constructed buildings.

Alternative S2 only passively addresses principal threats through capping, and would need to be coupled with an active groundwater remedy to satisfy the remedial action objectives.

Alternative S3: Solidification of Arsenic Source Areas, Soil Vapor Extraction of VOC Source Areas, and Capping

Estimated Capital Cost:	*$3,240,000*
Estimated Annual O & M Cost (0-2 yrs):	*$125,900*
Estimated Annual O & M Cost (3-50 yrs):	*$8,800*
Estimated Present Worth Cost:	*$3,630,000*
Estimated Construction Time frame:	*2.5 years*
Estimated O & M Time frame for SVE:	*2 years*

This alternative consists of a combination of treatment technologies to address the Source Areas, coupled with capping. In order to address the VOC-contaminated soil, this alternative includes installation of a soil vapor extraction (SVE) system. In addition, this alternative calls for the stabilization of soil with concentrations of arsenic over 300 ppm, through the addition of a concrete mixture into the soil.

The volume of soil containing VOCs to be treated with SVE is estimated at 12,150 cubic yards and the volume of soil containing arsenic to be stabilized is approximately 16,000 cubic yards; however, in some cases, the VOC Source Areas and the arsenic Source Areas overlap on the site. While stabilization has been successful in treating VOC-contaminated soil at some sites, SVE cannot be used to treat arsenic contamination. In addition, stabilization can be performed in one construction step, whereas

SVE involves the installation and operation of an in-ground system over a number of months or years. Under this alternative, stabilization would be performed first, including areas where arsenic and VOCs are co-located, followed by SVE in remaining areas with only VOC contamination. The O&M time frame estimated (above) is for the expected operation period of the SVE system.

This alternative also includes the demolition of the Rhodes Drums building and capping of residual soils, including the treated soils, similar to Alternative S2. Institutional controls, similar to those described in Alternative S2, would be required to assure the protectiveness of the cap and to prevent disturbance of the stabilized soil.

Alternative S4: Excavation and Off-site Transportation of Source Areas with Treatment as necessary prior to Land Disposal, Capping Residual Soils

Estimated Capital Cost:	*$6,400,000*
Estimated Annual O & M Cost (30 years):	*$8,800*
Estimated Present Worth Cost:	*$6,580,000*
Estimated Construction Time frame:	*5 months*

This alternative includes excavation of as much as 28,000 cubic yards of both the VOC and arsenic Source Areas, transportation, and off-site disposal, with treatment as necessary to allow for land disposal. The unexcavated portions of the Martin Aaron site, an area of approximately 2.0 acres where soils exceed the direct-contact Cleanup Goals, would be capped as presented in Alternatives S2 and S3. This alternative meets the remedial objectives by removing highly contaminated soils that are considered principal threat wastes, and by eliminating contact with the remaining soil contamination by capping. If the excavated soil exhibits hazardous characteristics as defined by the Resource, Conservation and Recovery Act (RCRA) treatment would be required prior to disposal to meet the RCRA Land Disposal Requirements (LDRs). For cost estimating purposes, the FS assumed 30 percent of the excavated soil would undergo treatment prior to disposal.

This alternative also includes the demolition of the Rhodes Drums building and capping of residual soils, including the treated soils, similar to Alternative S2. Excavated areas would be backfilled with clean fill. Institutional controls, similar to those described in Alternative S2, would be required to assure the protectiveness of the cap.

Alternative S5: Excavation and Off-site Transportation of Arsenic Source Areas with Treatment as necessary prior to Land Disposal, Treatment of VOC Source Areas via Soil Vapor Extraction, Capping Residual Soils

Estimated Capital Cost:	*$5,800,000*
Estimated Annual O & M Cost (0-2 yrs):	*$125,900*
Estimated Annual O & M Cost (3-50 yrs):	*$8,800*
Estimated Present Worth Cost:	*$6,190,000*
Estimated Construction Time frame:	*2.5 years*
Estimated O & M Time frame for SVE:	*2 years*

This alternative includes excavation of the arsenic Source Areas, transportation, and off-site disposal, with treatment as necessary prior to disposal, if required by the RCRA LDRs. In addition, the remaining VOC Source Areas would be addressed through the installation of an SVE system, as described in Alternative S3. The O&M time frame estimated (above) is for the expected operation period of the SVE system.

This alternative also includes the demolition of the Rhodes Drums building and capping of residual soils that exceed the direct-contact Cleanup Goals, similar to Alternative S2. Excavated areas would be backfilled with clean fill. Institutional controls, similar to those described in Alternative S2, would be required to assure the protectiveness of the cap.

Alternative S6: Excavation and Off-site Transportation of Residual Soils and Source Areas with Treatment as necessary prior to Land Disposal, Engineering Controls

Estimated Capital Cost:	*$8,300,000*
Estimated Annual O & M Cost:	*$0*
Estimated Present Worth Cost:	*$8,300,000*
Estimated Construction Time frame:	*8 months*

Alternative S6 would result in the excavation of all contaminated soils within the Source Areas and all contaminated soils exceeding the direct-contact Cleanup Goals. The depth of excavation varies from two feet to an estimated maximum depth of about 10 feet. The area of excavation would encompass a majority of the Martin Aaron property and on surrounding properties, resulting in excavation of approximately 64,500 cubic yards. Similar to Alternative S4, Source Area soils would be treated, as necessary, prior to land disposal to satisfy the RCRA LDRs.

This alternative also includes the demolition of the Rhodes Drums building. Because the site Cleanup Goals are protective for a commercial end-use, but not for unrestricted use, this alternative would not allow for unrestricted future use in some portions of the site. In that case, institutional controls similar to those described in Alternative S2 would be needed to assure the protectiveness of the remedy.

Common Elements for Groundwater Alternatives

Performance of the four active groundwater remedial alternatives would be greatly enhanced by an active soil remedy to address the soil Source Areas, which would substantially reduce both the volume of principal threat wastes at the site and groundwater contaminant contribution. None of the groundwater alternatives are expected to fully remediate the groundwater without an active soil remedy.

All active groundwater alternatives require a long-term monitoring program to assess effectiveness and to monitor any migration of contamination over time. While the zone of contaminated groundwater is not currently in use, and no water supplies are threatened, the active remedies (Alternatives GW2 through GW5) would require institutional controls such as a Classification Exception Area (CEA) to restrict use of the groundwater until remediation goals are achieved.

Since all the groundwater alternatives result in contaminants remaining on site above levels that would not allow for unlimited use, a review of the site at least every 5 years would be required.

GROUNDWATER ALTERNATIVES

Alternative G1: No Action

Estimated Capital Cost:	*$0*
Estimated Annual O&M Cost:	*$0*
Estimated Present Worth Cost:	*$0*
Estimated Construction Time frame:	*None*

Regulations governing the Superfund program generally require that the "no action" alternative be evaluated to establish a baseline for comparison. Under this alternative, EPA would take no action to prevent exposure to the groundwater contamination. Institutional controls would not be implemented to restrict future groundwater use.

If no soil or groundwater action is taken, groundwater contamination will persist above the remediation goals, and the plume may expand over time. If an active soil remedy addresses the source areas, but no groundwater action is taken, VOC and arsenic plumes would still persist for a number of years (roughly estimated at over 50 years).

Alternative G2: Monitored Natural Attenuation (MNA) and Institutional Controls

Estimated Capital Cost:	*$23,925*
Estimated Annual O & M Cost (0-2 yrs):	*$207,418*
Estimated Annual O & M Cost (3-50 yrs):	*$25,927*
Estimated Present Worth Cost:	*$550,000*
Estimated Construction Time frame:	*0 years*

Alternative G2 relies on natural attenuation to address the groundwater plume while placing use restrictions on the area of groundwater exceeding the Cleanup Goals until groundwater returns naturally to acceptable levels. Alternative G2 relies on remediation of the soil Source Areas (through the selection of an active soil remedy) and cannot satisfy the remedial action objectives alone.

Studies performed during the RI indicate that natural attenuation of VOCs is probably underway. Natural attenuation is a process by which contaminant concentrations are reduced by conditions already present in the groundwater, such as volatilization, dispersion, adsorption, and biodegradation. VOC contamination is amenable to natural attenuation under certain conditions, some of which appear to exist at the site. These natural degradation processes may decrease VOC contaminant concentrations over time, especially if an active soil remedy is undertaken to address VOC Source Areas. The prospects for natural mechanisms to decrease the concentration or mobility of arsenic in groundwater are very limited, though a soil remedy addressing arsenic Source Areas would improve groundwater conditions.

Under this alternative, a soil remedial alternative that either treats or removes the soil Source Areas would minimize further contaminant contribution to the plume, thus substantially decreasing the time until natural attenuation achieves the remedial goals. The main remedial components of this alternative include groundwater use restrictions and monitoring. Institutional controls, such as a CEA, would be implemented. The components of the CEA include the location of the restriction (including areas of potential migration before degradation reduces contaminant concentrations to below applicable cleanup goals), the compounds detected over the applicable cleanup goals, and the proposed duration of the restriction. This control would restrict future use of the groundwater within the area over the duration of the CEA.

Alternative G2 would require a monitoring program, which would establish a set of groundwater conditions that would be expected to be met over time, if natural attenuation is succeeding. If monitoring of the groundwater contamination indicates that natural attenuation would not achieve the remediation goals, active restoration with one of the other alternatives, G3, G4, or G5 presented later, would be implemented.

Alternative G3: Containment with Hydraulic Controls

Estimated Capital Cost:	*$1,600,000*
Estimated Annual O&M Cost:	*$580,000*
Estimated Present Worth Cost:	*$7,800,000*
Estimated Construction Time frame:	*3 months*

The objective of Alternative G3 is to intercept the contaminated groundwater using a series of extraction wells along the downgradient edge of the contamination to control the off-site migration of the plumes. This alternative would meet the remedial objectives by preventing downgradient migration of the plume and protection of any receptors, and eventual capture of the plume.

The alternative would consist of extraction wells, pretreatment of arsenic and VOC contamination, and discharge to the POTW (i.e., the Camden County Municipal Utilities Authority, CCMUA). The groundwater use restrictions are the same as described for Alternative G2, and a monitoring program would also be required.

While the lateral extent of the contamination extends to approximately 125 feet bgs, the bulk of the contamination is within 50 feet of the ground surface. Active pumping to a depth of approximately 50 feet is expected to contain the portion of the plume that has the highest potential to migrate. For cost estimation purposes, the FS assumed that three extraction wells along the downgradient edge of the plume, pumping at a combined 20 gallons per minute (20 gpm), would contain the plume. Because the arsenic and VOC plumes migrate at different rates, additional extraction wells could be installed within the arsenic plume to also control the migration of the arsenic plume.

If coupled with an active source control remedy for the soils, preliminary calculations estimate a time frame of 20 years to completely remediate the aquifer.

Alternative G4: Geochemical Fixation and MNA

Estimated Capital Cost:	*$1,200,000*
Estimated Annual O&M Cost:	*$26,000*
Estimated Present Worth Cost:	*$1,700,000*
Estimated Construction Time frame:	*6 months*

Alternative G4 includes geochemical fixation to address the arsenic-contaminated groundwater, along with MNA (similar to Alternative G2) to address the VOCs. Geochemical fixation involves introducing a polymer into an area with high arsenic concentrations. This particular process entails the mechanical mixing of an estimated 64,000 cubic yards of soil over the course of a number of months. The chemical process transforms metal contaminants to low-solubility precipitates. The conversion of contaminants to low-solubility precipitates eliminates their mobility and prevents them from being drawn into water wells if any wells were installed at the site in the future. At Martin Aaron, polymers would be introduced to a depth of approximately 15 to 20 feet. This depth includes the shallow aquifer and an underlying clay layer where the arsenic concentrations appear to be highest. A pilot study to evaluate methods of distributing chemicals and the resulting effectiveness would be required prior to full scale injection.

The groundwater use restrictions and MNA are as described in Alternative G2. This alternative would also include long-term monitoring to assess the effectiveness of the remedy. If coupled with an active source control remedy for the arsenic-contaminated soils, preliminary calculations estimate a time frame of 40 years to completely remediate the aquifer.

Alternative G5: Groundwater Collection and Treatment

Estimated Capital Cost:	*$1,700,000*
Estimated Annual O&M Cost:	*$700,000*
Estimated Present Worth Cost:	*$6,600,000*
Estimated Construction Time frame:	*3 months*

The objective of Alternative G5 is to aggressively remediate the contaminated groundwater plume by extraction and treatment of all of the contaminated groundwater, with discharge of the treated water to the CCMUA. The groundwater extraction and treatment system would consist of extraction wells, on-site pretreatment (assumed, for cost-estimating purposes, to be a combination of air-stripping and vapor-phase carbon to address the VOCs and chemical precipitation to address metals), and discharge to the POTW. The extraction wells would be placed in the contaminated portions of the plume to depths of approximately 50 feet, pumping at a combined rate of 85 gpm. In order to determine if chemical precipitation would be necessary, contaminant concentrations were estimated for the collection system discharge and compared against the CCMUA pretreatment limits. Arsenic was the only groundwater contaminant that may exceed the limits. Based on this evaluation, arsenic removal with chemical pretreatment would be needed prior to discharge to CCMUA. The groundwater use restrictions and monitoring of groundwater are as previously described in Alternative G2.

If combined with an active soil remedy to address the Source Areas, it has been estimated that this system would be operated for 10 years to restore the aquifer.

COMPARATIVE ANALYSIS OF ALTERNATIVES

In selecting a remedy, EPA considered the factors set out in CERCLA §121, 42 U.S.C. §9621, by conducting a detailed analysis of the viable remedial response measures pursuant to the NCP, 40 CFR §300.430(e)(9) and OSWER Directive 9355.3-01. The detailed analysis consisted of an assessment of the individual response measure against each of nine evaluation criteria and a comparative analysis focusing upon the relative performance of each response measure against the criteria.

Threshold Criteria - *The first two criteria are known as "threshold criteria" because they are the minimum requirements that each response measure must meet in order to be eligible for selection as a remedy.*

1. Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

Soils

The no action alternative is not protective because it does not prevent direct contact with site soils and allows continued leaching of VOCs and metals to groundwater.

Alternatives S2 through S6 are all considered protective of human health because they all prevent direct contact with contaminated soils in excess of the direct contact Cleanup Goals. Because the direct-contact Cleanup Goals are appropriate for commercial or industrial uses, but not for unrestricted use, the implementation of institutional controls such as a deed notice would be required for any of the active remedies to assure protectiveness over the long term. Alternative S2 relies primarily on capping and institutional controls to meet the remedial action objectives, and does little on its own to address the arsenic and VOC Source Areas.

Groundwater

The no action alternative is not considered protective because it does nothing to prevent exposure to contaminated groundwater in the future, which would result in unacceptable future risks.

The remaining alternatives are considered protective. Alternative G2 (MNA and Institutional Controls) is considered protective because it includes restrictions on the use of groundwater and includes groundwater monitoring to evaluate natural attenuation and ensure that the plume does not migrate to areas that would result in human exposure. Alternatives G3 through G5 also meet the threshold of preventing human exposure. Alternatives G3, G4, and G5 take differing approaches to controlling or remediating the groundwater contamination; however, none of these alternatives are expected to remediate the groundwater without the aid of a complimentary soil remedy that addresses the soil Source Areas.

All alternatives except the "no action" alternative would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, or through engineering or institutional controls.

2. Compliance with applicable or relevant and appropriate requirements (ARARs)

Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are *collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).*

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those State standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for a invoking waiver.

Soils

There are no chemical-specific ARARs for the contaminated soil. The Cleanup Goals are risk-based for the surface soils, and are similar to NJDEP's non-residential direct contact soil criteria. In addition, NJDEP has developed Impact to Groundwater Soil Cleanup Criteria to address sources of groundwater contamination in deeper soils, and EPA considered these criteria in developing the Source Area Cleanup Goals for this site. Alternative S2 relies on capping to address the direct contact Cleanup Goals, and Alternative S6 relies on excavation. Alternatives S3, S4, and S5 rely primarily on capping to achieve the direct contact Cleanup Goals.

Alternative S2 does little to meet the source control Cleanup Goals, besides some reduction in surface water infiltration that would reduce contaminant mobilization. Alternative S2 paired with groundwater Alternative G3 (Containment and Hydraulic Controls) could achieve the source control Cleanup Goals in soils through a containment strategy. Alternatives S3 through S6 would satisfy the source control Cleanup Goals through various combinations of treatment and excavations.

Based upon the available documentation regarding the site, EPA has concluded that the soil contaminants are not listed hazardous waste. Some soil testing has identified soils that exhibit hazardous characteristics, and if excavated, these soils would need to be treated to meet RCRA Land Disposal Restrictions prior to disposal in a RCRA-compliant unit.

Location- and Action-specific ARARs would be met under all the active alternatives.

The site does not contain any wetlands nor is it considered located in a flood plain or coastal zone.

Groundwater

The groundwater Cleanup Goals identified in Appendix II, Table 7, are MCLs or groundwater quality standards and, therefore, ARARs. Alternative G1 (No Action) would not meet ARARs. Alternative G2 (MNA and Institutional Controls) relies on the effectiveness of a complimentary soil remedy to remediate source areas, after which natural attenuation would eventually allow the aquifer to recover. Depending upon the selected soil remedy, the most highly contaminated arsenic in groundwater would not recover in a reasonable time frame under Alternative G2. None of the active groundwater treatment Alternatives (G3, G4 and G5) are expected to restore the aquifer without implementation of a soil source control remedy.

Alternatives G2 through G5 would require institutional controls, such as a CEA, to control use of the groundwater until groundwater Cleanup Goals can be met.

Because the No Action alternatives (S1 and G1) do not meet the threshold criteria (Protection of Human Health and the Environment and Compliance with ARARs), they were eliminated from consideration under the remaining seven criteria.

A complete list of ARARs can be found in EPA's July 2005 Draft-Final Feasibility Study, Appendix A.

Primary Balancing Criteria *- The next five criteria, criteria 3 through 7, are known as "primary balancing criteria". These criteria are factors with which tradeoffs between response measures are assessed so that the best option will be chosen, given site-specific data and conditions.*

3. Long-term effectiveness and permanence

A similar degree of long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain on-site following remediation and the adequacy and reliability of controls.

Soils

Alternative S6 offers the highest degree of permanence because it is expected to achieve the greatest removal of arsenic and VOCs from the soils through excavation and off-site treatment and disposal. Alternative S4 is the next best alternative relative to long-term effectiveness since the largest mass of contaminants is removed from the site. Alternatives S3 and S5 are ranked lower than S4 and S6, since they involve in-situ treatment of the soil Source Areas, but they are still effective and permanent in the long-term. Alternative S2 is considered the least effective alternative in the long-term because it does not remove VOCs or arsenic or limit leaching to groundwater.

Groundwater

While several of the groundwater alternatives can adequately control the groundwater contamination and even reduce contaminant mass, none of the groundwater alternatives are effective in the long term without the implementation of a source control remedy for soils. In addition, the presence of clay and silt lenses within the shallow aquifer will make groundwater restoration difficult, especially for arsenic, since metals tend to sorb onto clay particles making them difficult to remediate.

Alternative G5 ranks higher than Alternative G3 (the two pumping alternatives) in long-term effectiveness and permanence since its goal is to restore aquifer conditions in a reasonable period of time, whereas Alternative G3 is only meant to control migration. Alternative G4 ranks higher than Alternatives G3 and G5 for the arsenic plume because the arsenic is quickly treated after injection, curtailing or eliminating mobility. Alternative G4 ranks lower than the pumping alternatives (G3 and G5) for the VOC portion of the plume. In addition, for Alternative G4, treatability studies would be required to evaluate the permanence of geochemical fixation, considering whether the in-situ chemical reactions may be reversible under potential future site conditions.

Alternative G2, Natural Attenuation and Institutional Controls, may not attain the goal of aquifer restoration in a reasonable time frame, because the highest concentrations of arsenic in the groundwater may take 50 or more years to reach acceptable levels.

4. Reduction of toxicity, mobility, or volume
Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Soils

Alternative S2 does not reduce the mobility, toxicity or volume of contaminants through treatment.

SVE is the only technology considered that would destroy contamination from the Source Areas, reducing the toxicity, mobility and volume of the VOC contamination. Solidification also would reduce the toxicity and mobility, but not the volume, of the arsenic Source Areas because the metal contamination would remain on site. Solidification can result in an increase in contaminant volume through the addition of concrete mixtures to the soil.

Regarding off-site disposal remedies, only Source Area soils that would be considered RCRA-characteristic waste would be treated prior to disposal. Therefore, Alternatives S6, S5 and S4, which address the Source Areas through excavation and off-site disposal, are comparable.

Alternatives S3 and S5 would be rated highest in this criterion by addressing the VOC Source Area soils through treatment. Alternatives S3 through S6 are comparable with regard to addressing the arsenic Source Area soils.

Groundwater

Alternative G4 employs a treatment technology, geochemical fixation, that reduces the toxicity and mobility of arsenic, though it does not address the VOC contamination. Pumping and treatment alternatives (G3 and G5) physically remove the arsenic (and VOCs) from the aquifer. Alternatives G4 and G5 offer a comparable level of improvement in mobility and toxicity reduction, and would be rated higher than the hydraulic containment Alternative G3.

5. Short-Term Effectiveness
Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.

Soils

Alternative S2 has the least potential for construction-related impacts on workers, the community or the environment because it involves minimal construction.

Air monitoring would be an important component for all of the excavation alternatives (S4, S5, and S6) and for any on-site treatment technologies (S3 and S5) so that workers would wear the appropriate health and safety protection equipment during intrusive construction activities. Perimeter air monitoring would be required to assure that no vapor or dust releases occur during construction or O&M phases. Emission control techniques, such as the use of dust suppressants and minimizing the open working area of the excavation, would be employed as needed to minimize adverse affects on workers and the community from the site. Trucking routes with the least disruption to the surrounding community would be utilized.

Appropriate transportation safety measures would be required during the shipping of the contaminated soil for off-site disposal.

Alternative S6 is the most disruptive alternative to local properties because it would involve the largest soil excavation and could temporarily disrupt activities at, for example, Comarco Products.

Alternatives S4, S5, and S6 achieve remedial action objectives more quickly than Alternatives S2 and S3 since they each involve some type of excavation, which takes less time to implement. Of S4, S5 and S6, Alternatives S4 and S6 achieve remedial action objectives most quickly.

The time required for implementation of Alternative S2 is estimated at two months. Alternative S3 is estimated to take 2.5

years, because SVE is expected to take as long as two years to remediate the VOC Source Areas. The time frame for Alternative S3 assumes concurrent implementation of the SVE and solidification treatment technologies; however, the SVE treatment may need to be completed before solidification can be undertaken on portions of the site, extending the time frame for this alternative to as much as four or more years. Alternative S4 is estimated to take five months, Alternative S5 is estimated to take about 2.5 years, and Alternative S6 is estimated to take about eight months to implement.

Groundwater

Alternative G2 has no community impacts because it involves no construction. Alternatives G3 and G5 have minimal impacts with respect to the protection of workers, the community, and the environment during remedial construction. Alternative G4 has potential worker, community and environmental impacts due to the injection of a high pH material into the aquifer and the substantial soil mixing. Some emissions of VOCs and dust would be unavoidable, though risks to public health would be minimized through air monitoring and emission control measures. Alternative G4 is also likely to be the most disruptive to the community during construction.

The short-term effectiveness with respect to the time until the remedial action objectives are achieved is quickest for the groundwater collection and treatment Alternatives (G3 and G5). The time frames discussed below assume that a source control remedy in soils is implemented. For Alternative G5, it is expected that MCLs in groundwater (with the possible exception of the shallow groundwater closest to the arsenic Source Areas) will be achieved in as little as 10 years. Alternative G3, which is a containment remedy, has a remediation time frame for the VOCs (20 years) but does little to actively address the highest arsenic contamination. Alternative G4 will achieve the remedial action objectives faster than Alternative G3 for arsenic, but will rely on natural attenuation of the VOC plume, which will take longer. Alternative G2 may reach the VOC Cleanup Goals in 45 years, through natural attenuation, after the source is removed, but is not expected to address arsenic.

6. Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Soils

No technical implementability concerns exist for Alternatives S2 and S4. Alternative S6 would require the participation of a number of neighboring property owners and may require the curtailing or temporary relocation of operations at Comarco Products. All technical components of these alternatives would be easily implemented using conventional construction equipment and materials. Alternatives S3 and S5 would require treatability studies during remedial design, evaluating how best to implement the SVE system to remove the VOCs, and the solidification of the arsenic. Even after treatability studies to determine the appropriate injection points, solidification agents, dosage rates, and other performance parameters, the uncertainties regarding the implementability would still be high, especially given the heterogeneous nature of the fill material at the site. One way to increase the effectiveness of solidification would be to remove the heterogeneous fill material unsuitable for solidification, for off-site disposal; however, this introduces additional complexities and cost to its implementation.

Groundwater

Alternatives G2, G3 and G5 can be constructed at the site, and no technical or administrative implementability problems are expected for these alternatives. There is uncertainty, as highlighted in PRP comments received during the public comment period, as to the effectiveness of the two pumping remedies, Alternatives G3 and G5, in removing arsenic in the shallowest zones where arsenic concentrations are highest. Neither Alternative G3 or G5 may be able to meet the arsenic MCL in the shallow groundwater because of the relatively thin saturated thickness and low permeability of the soil. These conditions could lead to dewatering of the shallow groundwater above the clay and limit the ability to flush dissolved arsenic to the collection wells.

Alternative G4 will require studies to determine a proper chemical dose and mixing needs for precipitation of arsenic. The uncertainties regarding implementability are considered high for Alternative G4, relative to all other groundwater alternatives, not the least of which would be determining whether the chemical precipitation of arsenic would indeed be irreversible over potential future site conditions. The chemical mixing process anticipated, rotary blending equipment operating to depths of 17 to 20 feet, has a number of implementability issues, including problems with subsurface debris (similar to Alternative S3), and access limitations (needing to work around buildings that may sit over portions of the arsenic plume). Other methods of introducing the fixation chemicals may be effective; however, some of the same aquifer conditions that may limit the implementability of Alternative G3 and G5 (low permeability silt and clay lenses) would also limit the effectiveness of geochemical fixation unless physical mixing is employed. Treatability studies would be necessary to determine whether these implementation concerns can be over come.

Discharging extracted groundwater to the POTW raises administrative implementability concerns; however, the FS alternatives were developed in consultation with CCMUA. Pretreatment to satisfy CCMUA's sewer use ordinance may be required.

7. Cost

Includes estimated capital and O&M costs, and net present worth value of capital and O&M costs.

Soils

The cost of <u>Alternative S1</u> is $0.

The estimated present worth cost of <u>Alternative S2</u> is $3,310,000 which includes monitoring of the cap costs over a 50-year period.

The estimated present worth cost of <u>Alternative S3</u> at $3,630,000 is less than the present worth cost associated with <u>Alternative S4</u> which is $6,580,000. While Alternative S3 is less costly than Alternative S4, there are more uncertainties associated with on-site treatment that may increase the cost of this alternative, as compared to Alternative S4.

The estimate present worth cost of <u>Alternative S5</u> is $6,190,000, and for total soil contamination excavation, treatment and off-site disposal, <u>Alternative S6</u> is $8,300,000.

Groundwater

The cost of <u>Alternative G1</u> is $0.

The estimated present worth cost of <u>Alternative G2</u> is $550,000. This cost includes costs associated with the installation of a few additional monitoring wells, the sampling and analysis for natural attenuation of contamination in the groundwater, and operation and maintenance costs over a 50-year period.

The estimated present worth cost of <u>Alternative G3</u> is $7,800,000. This cost includes the costs mentioned in Alternative G2 with the